APPENDIX D. REVISION OF PHOSPHORUS CONCENTRATIONS IN STORMWATER RUNOFF

TECHNICAL MEMO

To: Critical Area Commission
From: Center for Watershed Protection

Re: Proposed Simplification of the 10% Method

Recommendation: Apply a Single "C" value of 0.3 mg/l for both new development and redevelopment to characterize total phosphorus (TP) concentrations in stormwater runoff from the Maryland Critical Area.

Background

When the first 10% rule guidance was published in 1987, we had limited monitoring data to define phosphorus (P) concentrations. The major source was the Washington, D.C. area NURP study, which involved about 300 stormwater samples at about 12 suburban single land use catchments. The group mean concentration was 0.26 mg/l of total P, and no statistically significant difference was found among the catchments. This concentration value was then used to characterize TP levels from new development.

Baltimore also conducted a NURP study in the early 1980s that sampled stormwater quality from much more urban catchments. The study reported much higher TP concentrations than in the Washington area, but these were found to be elevated by the almost chronic sewage overflows in the small watersheds they sampled (and which are still experienced today). The tricky part is that the authors could not tell how much of the elevated TP concentration was due to stormwater and how much to overflows. The prevailing view at the time was that highly urban catchments probably did have higher TP concentrations, but the Baltimore data could not be used to define the redevelopment TP concentration.

To fill the gap, we used a study conducted in DC from a catchment in its downtown business district that had a 1.08 TP concentration, which was intermediate between the Baltimore and Washington data. The unpublished study has apparently disappeared; I could not find it when we were doing the revision in 1992. As I recall it was done for DC government, used older time-compositing sampling techniques that have since been found to elevate TP concentrations, and had less than ten storm events sampled. It was the best we had at the time, so we went with it.

The use of the 1.08 mg/l value for redevelopment has had unintended consequences over the last 15 years. First, it made compliance with the 10% rule harder at redevelopment sites than new development sites, which is contrary to Maryland's smart growth policies developed in the late 1990s. On the operational side, it has frustrated plan reviewers and consultants alike, since they had to classify the site

as to whether it was new or redevelopment, based on impervious cover thresholds of 15 and 20%, respectively. It also added additional worksheets and steps to the process. But like a lot of things, the higher redevelopment TP concentration was used because of the prevailing but untested assumption that highly urban sites probably did produce more TP than suburban ones.

Current TP Monitoring Data

Quite a bit of stormwater monitoring has taken place both in Maryland and across the nation in the last decade since the 10% revision was completed in 1992. The data clearly do not support the continued use of 1.08 ppm to define redevelopment TP concentrations, and suggest that the 0.26 mg/l to define new development may be a shade low. Let me quickly review the findings from the three most intensive data reviews available on phosphorus levels in urban stormwater runoff.

The first is Schueler (1999) which reviewed TP concentrations from 37 residential catchments that collectively represented about 500 individual storm event samples. The group mean for TP was 0.3 mg/l with a range from 0.1 to 0.66 mg/L. This suggests that a higher TP might be used for new development, and also suggests that an average concentration of 1.08 mg/l did not occur anywhere else in the country.

The next evidence is from MDE Water Management Administration which did a statistical review in 1997 of all the municipal monitoring data generated by the Phase I stormwater communities in the State. The review at the time included 107 storm events collected from Anne Arundel, Baltimore, Howard, Montgomery, and Prince Georges County, as well as the City of Baltimore. The overall results for TP concentrations are shown below:

Residential Sites	0.37 mg/l of TP
Commercial Sites	0.22
Industrial	0.33
All Sites	0.31

Note: sample n is not 107 for each land use

Again evidence for a higher TP for new development, and no evidence to support the 1.08 ppm. Also, evidence of some land use differences, although not dramatic ones.

The final nail in the coffin is a national database that we have produced in association with Dr. Robert Pitt of the University of Alabama. Preliminary findings from this database, which contains more than 3,783 storm event samples for TP, are shown below:

Residential	0.31 mg/l of TP
Commercial	0.23
Industrial	0.27
Freeway	0.25
All Sites	0.27

Once again the pattern is confirmed: TP of 0.3 mg/l or so characterizes much of new and existing development. Some of the land use differences were found to be statistically significant, but they are pretty minor. Most of all, the new database gives us an opportunity to analyze how often a 1.08 mg/l concentration is found in urban stormwater runoff nationally. My quick look indicated less than 1% of all samples. I think it is a good thing the unpublished DC study is lost to history, because it was such an outlier.

Suggested Revision
We believe that a single TP concentration value of 0.3 mg/l should be used for the 10% rule. This would greatly simplify the calculations and is based on the best science available.